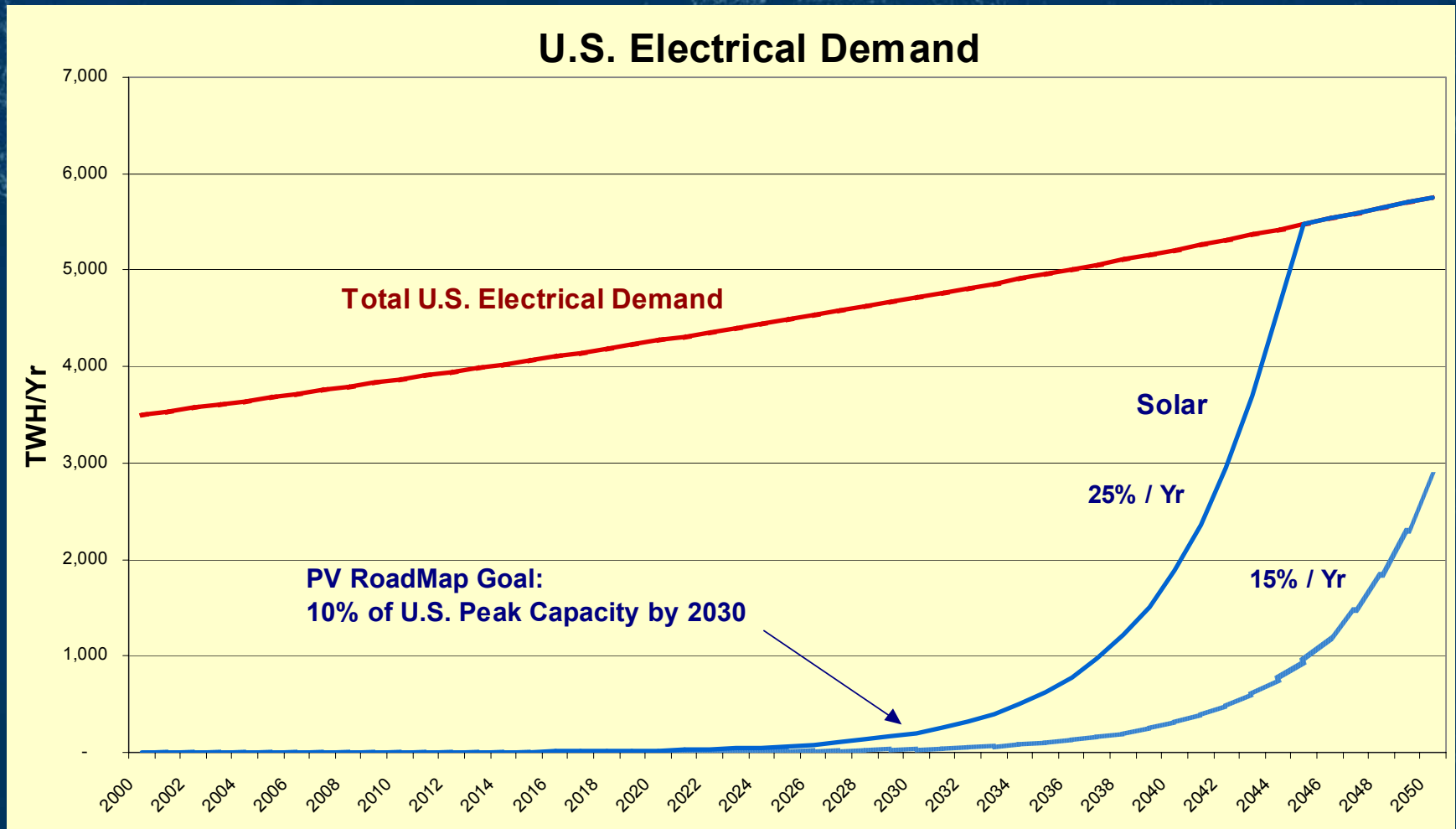


Commercial PV Systems Range in Size from 5 kW to 5 MW

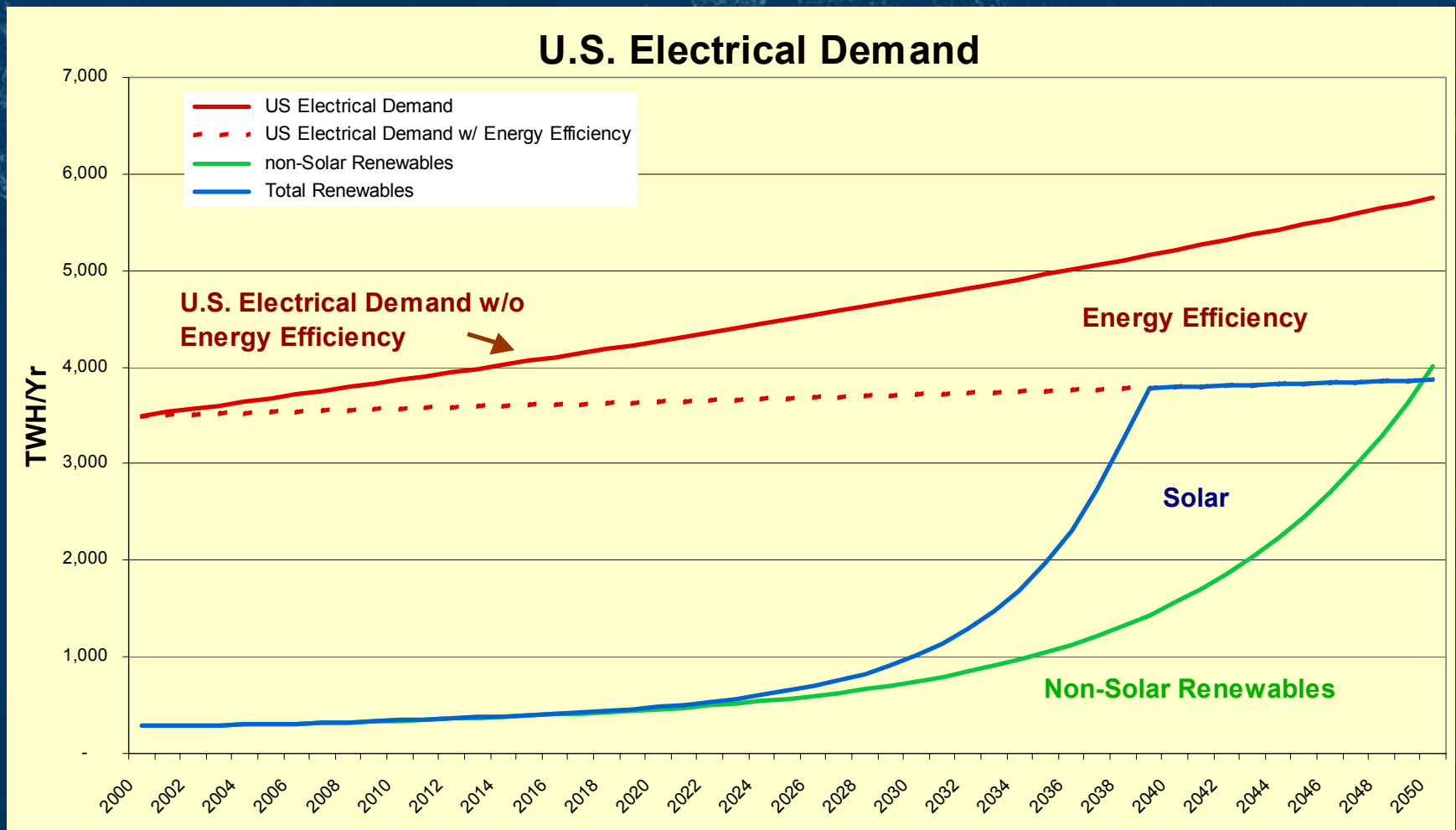
1.2 MWp at S. Rita, California



PV Industry Growth vs. U.S. Electrical Demand

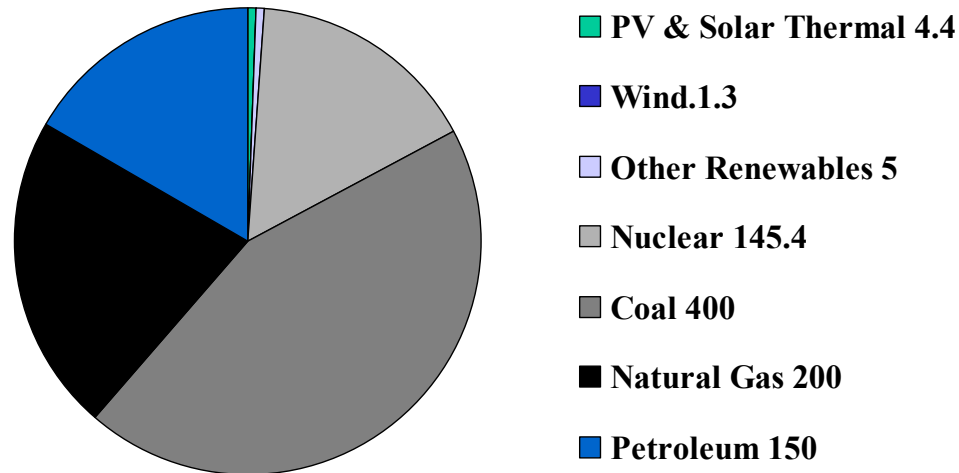


Renewables Roadmap: Renewables Growth vs. U.S. Electrical Demand



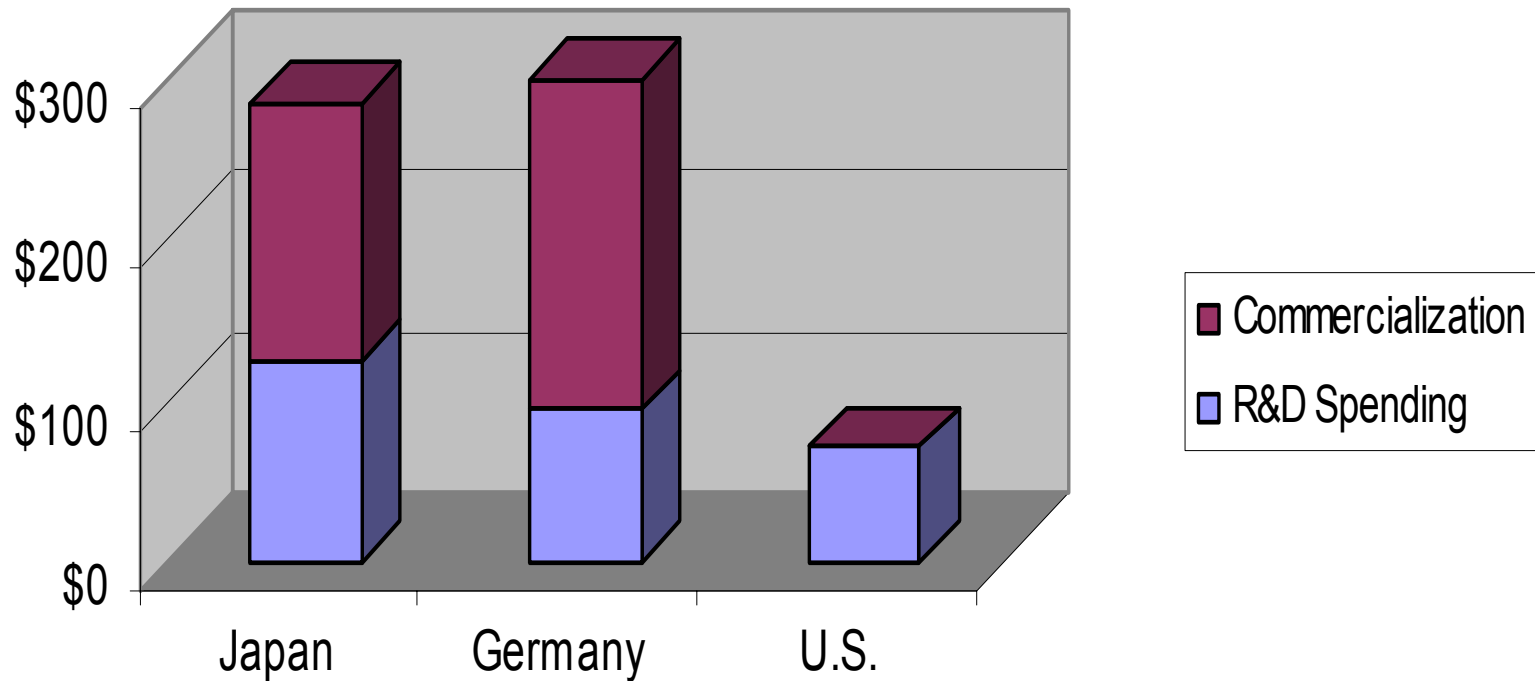
Federal Support for Renewables Has Been Minimal

1943-1999 US Federal Subsidies:
Renewable Energies vs. Other Energy Sources
(\$ Billions)

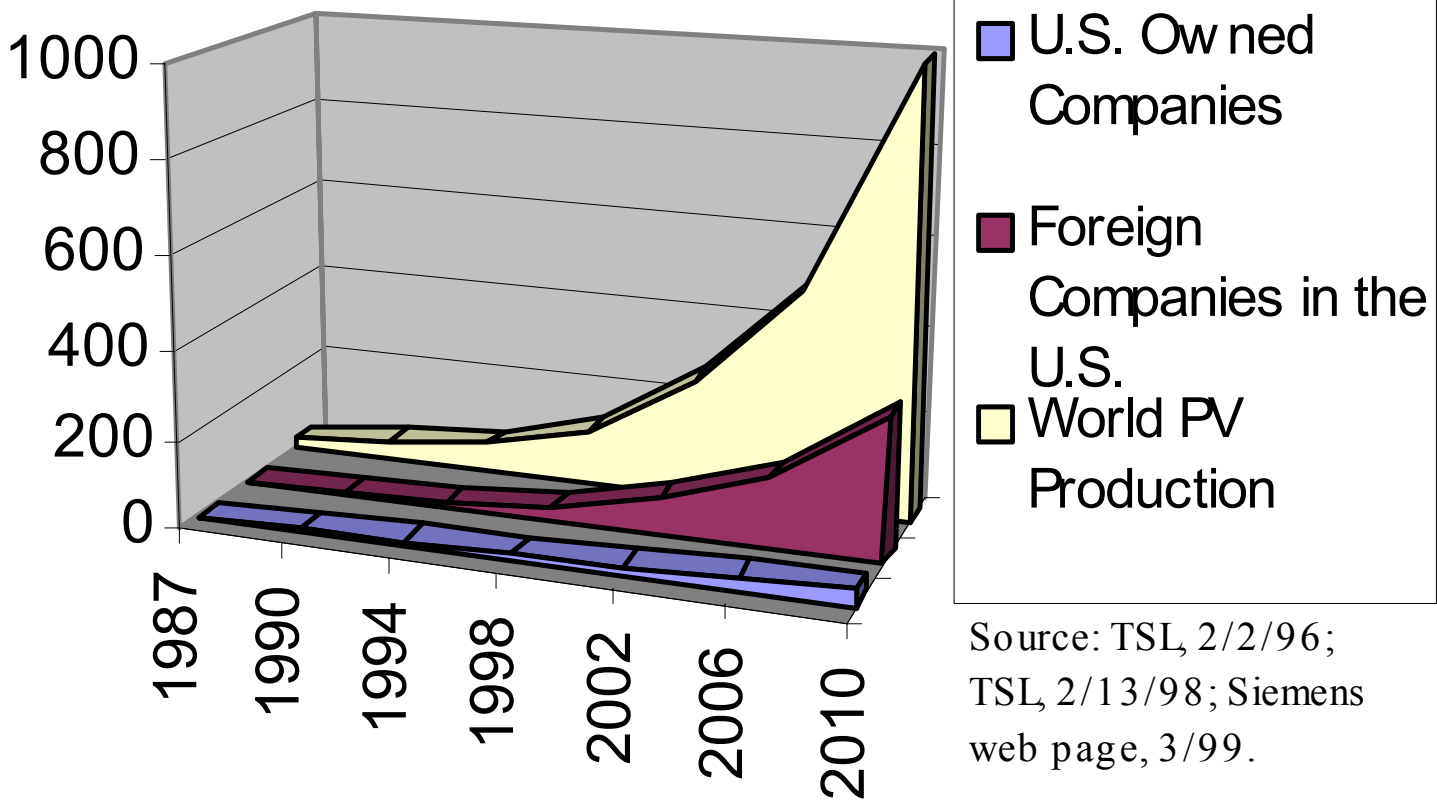


Source: Renewable Energy Policy Project, Research Report 11, "Federal Energy Subsidies: Not All Technologies Are Created Equal," MRG & Associates, an environmental and economics consulting firm, Madison, WI. July 2000.

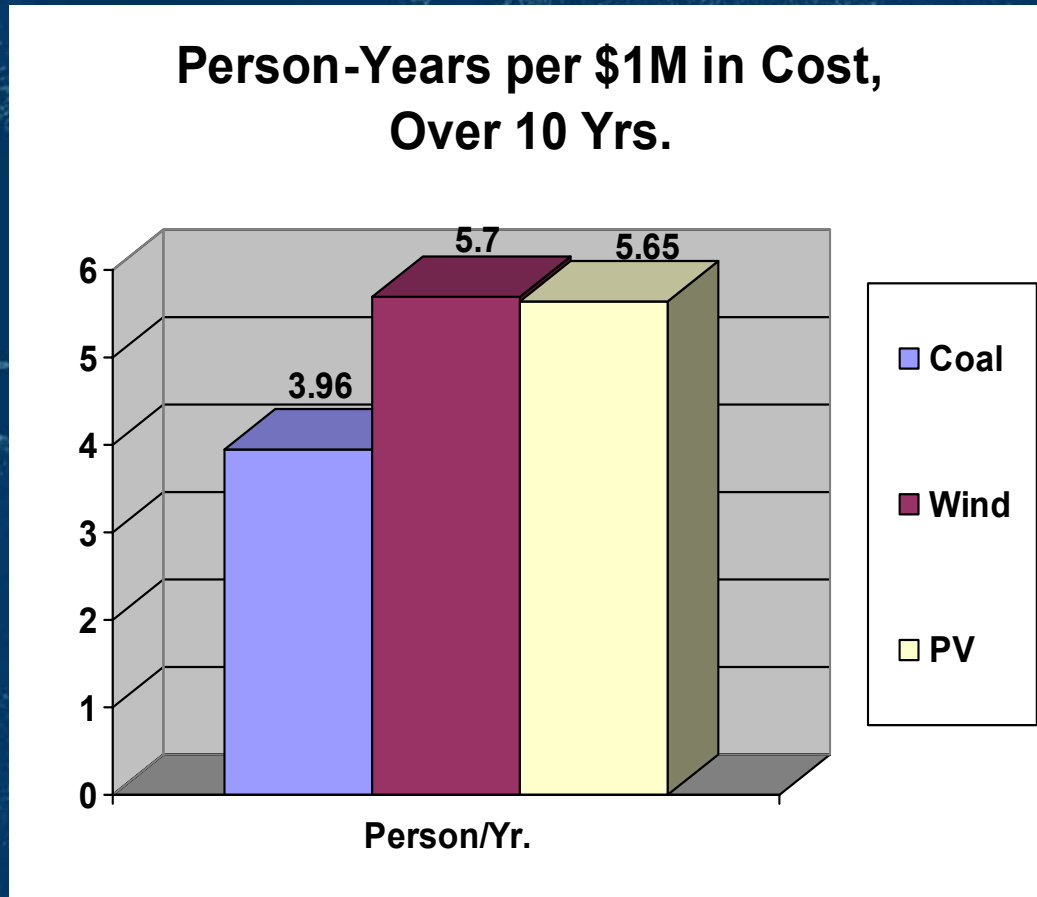
Losing the PV Race: Comparative Federal Investment in PV (\$M)



U.S. Owned PV Production has declined dramatically relative to world production



PV provides more jobs/MW than Coal



PowerLight Corporation Overview

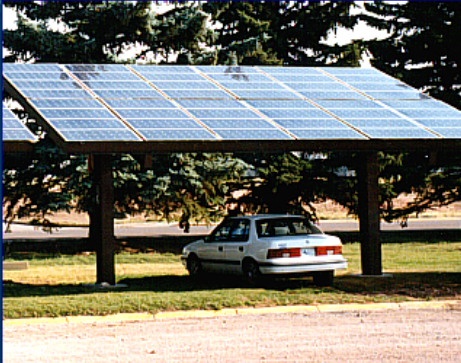
- **PV Sys Manufacturer & Solutions Provider**
Focus: Commercial / Industrial / Utility
- **Founded 1991; Based in SF Bay Area**
- **Global offices and customer base**
- **High internal growth**
 - 1) 2x each year since 1997
 - 2) “Inc. 500” last 2 Years
- **Profitable since inception**
- **Grid-Tied Leader; with 60% Market Share in America**



PowerLight Corporation

PowerLight's products: high-value solar electric systems

PowerShade



PowerGuard



PowerRoof



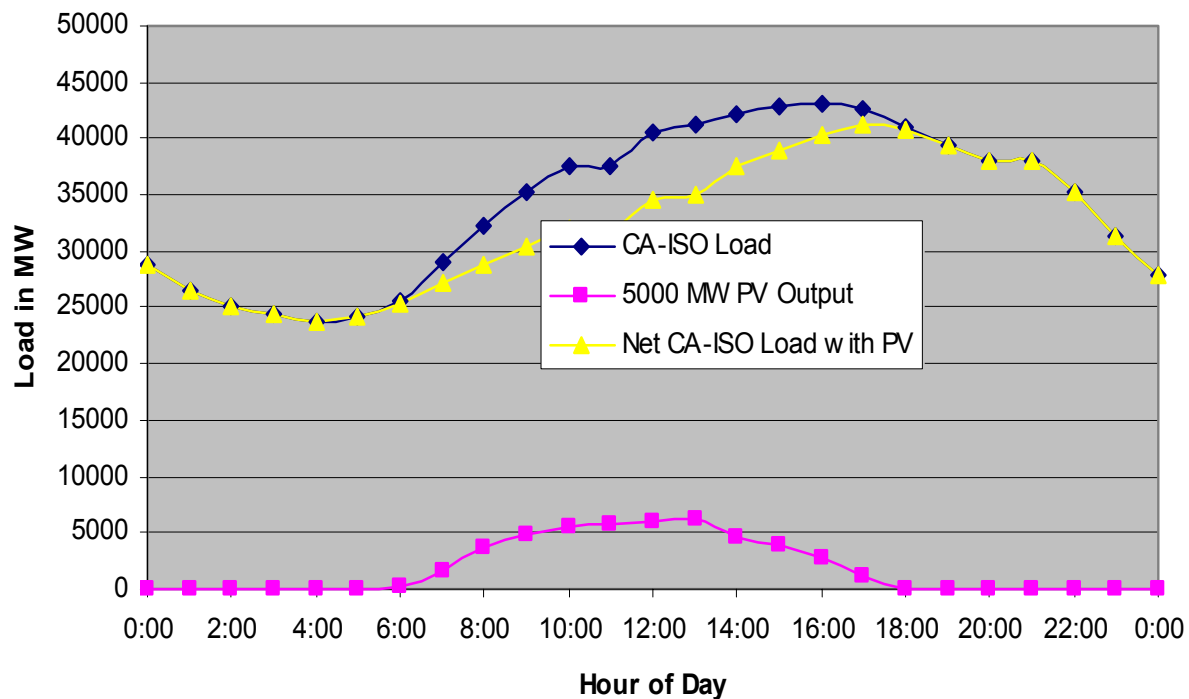
PowerTracker





PV is coincident with customer loads

June 15 2000 CA ISO Load



Load Match: Potential Benefits

- *Peak Energy*
- *Loss Savings*
- *Peak Capacity*
- *Defer T&D Upgrade*
- *Voltage Support*
- *Operational Savings*

Selected PV Integration Considerations

- 1. Efficiency (5 to 15 watts / square foot)**
- 2. Frame or Frameless (Up to \$20/module)**
- 3. Mechanical Size**
- 4. Mechanical Strength (tempered vs annealed)**
- 5. Operating Voltage & Fusing Requirements**
- 6. Color**
- 7. Reflectivity**
- 8. Fire Rating (Class A, B, or C)**
- 9. UV Transmissivity**

Component vs System Procurement: Design & Procurement Realities

- 1. No Module Best for Every Application**
- 2. No one PV technology “Winner”; many winners.**
- 3. The least expensive PV in \$/W often does not result in the most affordable system**

Always Purchase Turn-Key Systems with Warranties!

Tangent - For NREL Only -
Thin-Film vs Crystalline; Time for a status check

Over the last 8 years:

- 1. Solar grade silicon prices have dropped by 10X**
- 2. Thin-film commercialization has slipped substantially**
- 3. Crystalline technologies have improved dramatically**

Selected PowerLight Thin-Film Projects: 1994 to 2002

30 kW First Solar
Rhode Island, 8/2000



600 kW UniSolar
Bakersfield, 5/02



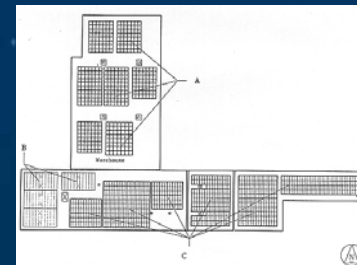
3 kW APS
Folsom, CA 9/94



270 kW BP Apollo
Dublin, CA, 8/01

42 kW BP a-Si
Cape Charles, VA, 9/99

45 kW BP a-Si
Sacramento, 6/98

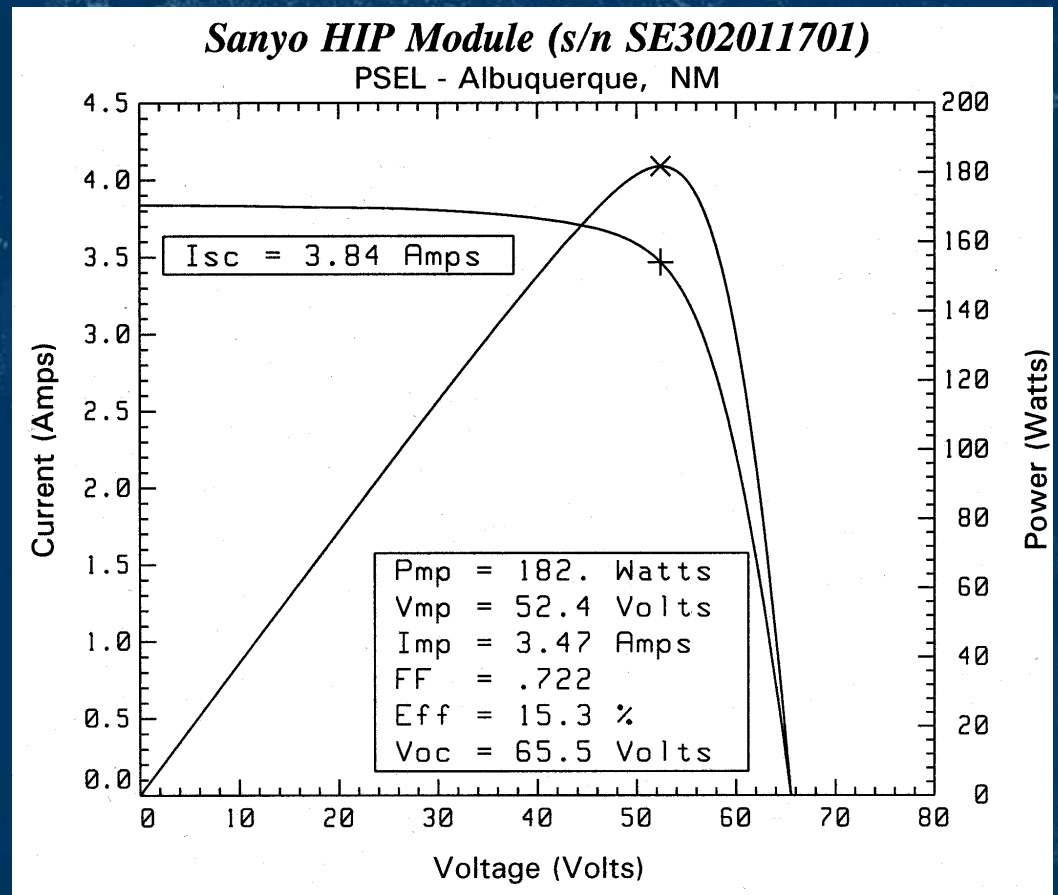


Integration Considerations for PV Power Modules > 40 watts

		Thin-Film (Glass Substrate)	Crystalline Technologies	Approx. Sys. Cost Impact to Thin-Film
1	Module Power (to Edge)	4 to 7.5 W/Ft ²	10 to 15 W/Ft ²	\$0.30/W - \$1.25/W
2	Mechanical Strength	Annealed/ Heat Strengthened	Tempered (5 to 10X stronger)	\$0.06/W - \$0.30/W
3	Lamination QA/QC	Poor	Good	Included in #2
4	Module O.C. Voltage	45V to 100V typ.	20V to 50V typ.	\$0.03/W - \$0.33/W
5	Typical 'String' Power	200W to 750W	1500W to 3000W	Included in #4
6	Stability	Poor	Good (Not Great)	\$0.30/W - \$0.60/W
7	Voltage Isolation	Intermittent	Excellent	Included in #6
8	Module Design Flex.	Poor	Excellent	Not quantified
9	Blocking Diode Req'd	Yes	No	\$0.02/W - \$0.05/W
10	Opaque to UV?	No	Yes	\$0.00/W - \$0.10/W
11	End of Life Recycle?	Some	No	<u>\$0.00/W - \$0.20/W</u>
Avg cost impact:		\$1.77/W	TOTAL:	\$0.71/W - \$2.83/W

Crystalline Progress Example: Sanyo HIP Technology

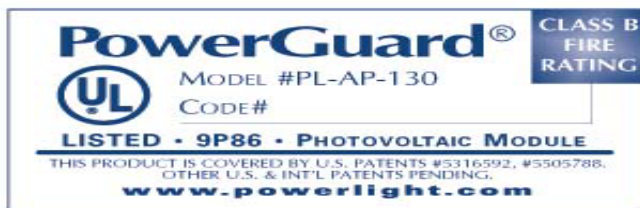
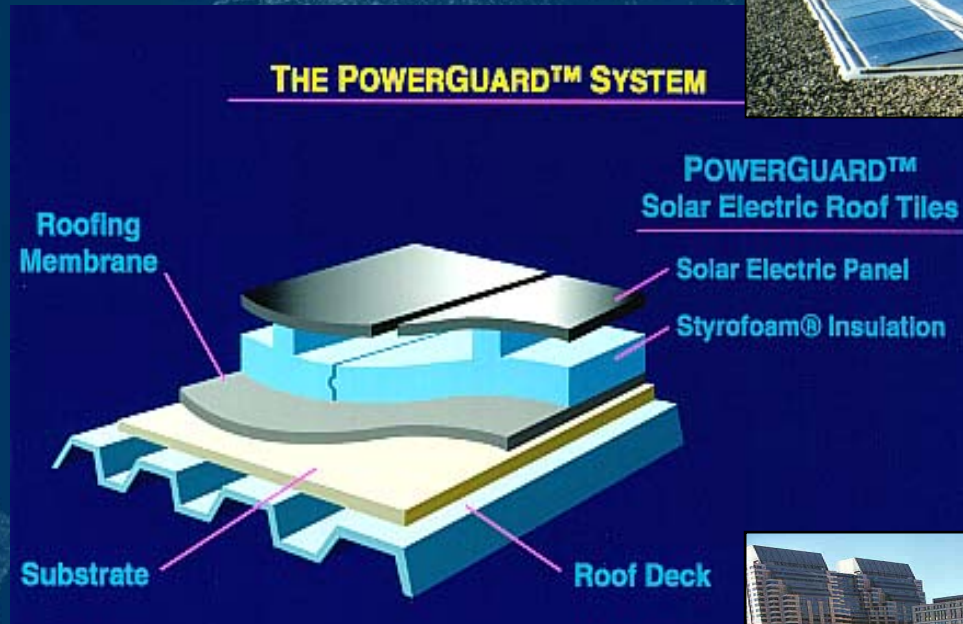
17.3% Cell / 15.3% module, outdoor testing



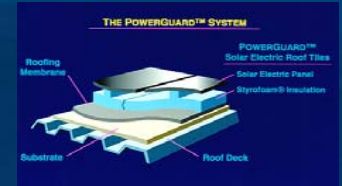
PowerGuard®

The best mounting solution for flat roofs

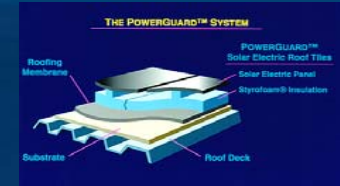
- Patented
- Lightweight
- No penetration
- Insulates roof
- Class A/B Fire
- Pre-engineered
- UL listed



PowerGuard® Palletized shipping and lifting

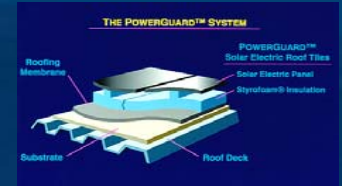


PowerGuard®
Fast non-invasive installation



PowerGuard®

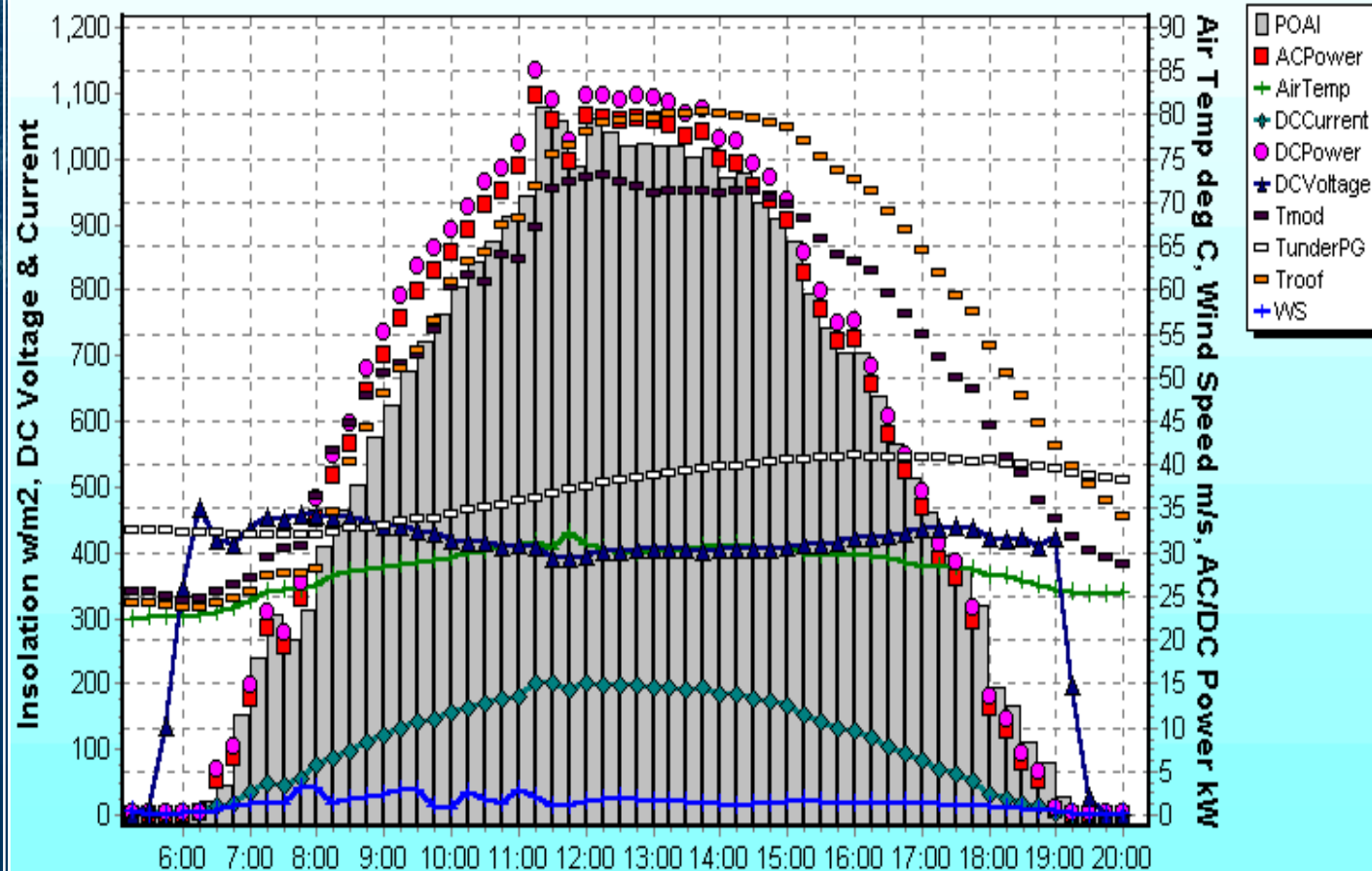
Completed Array. 120 kW Installed in 1 day



PowerGuard® Monitoring performance of each system

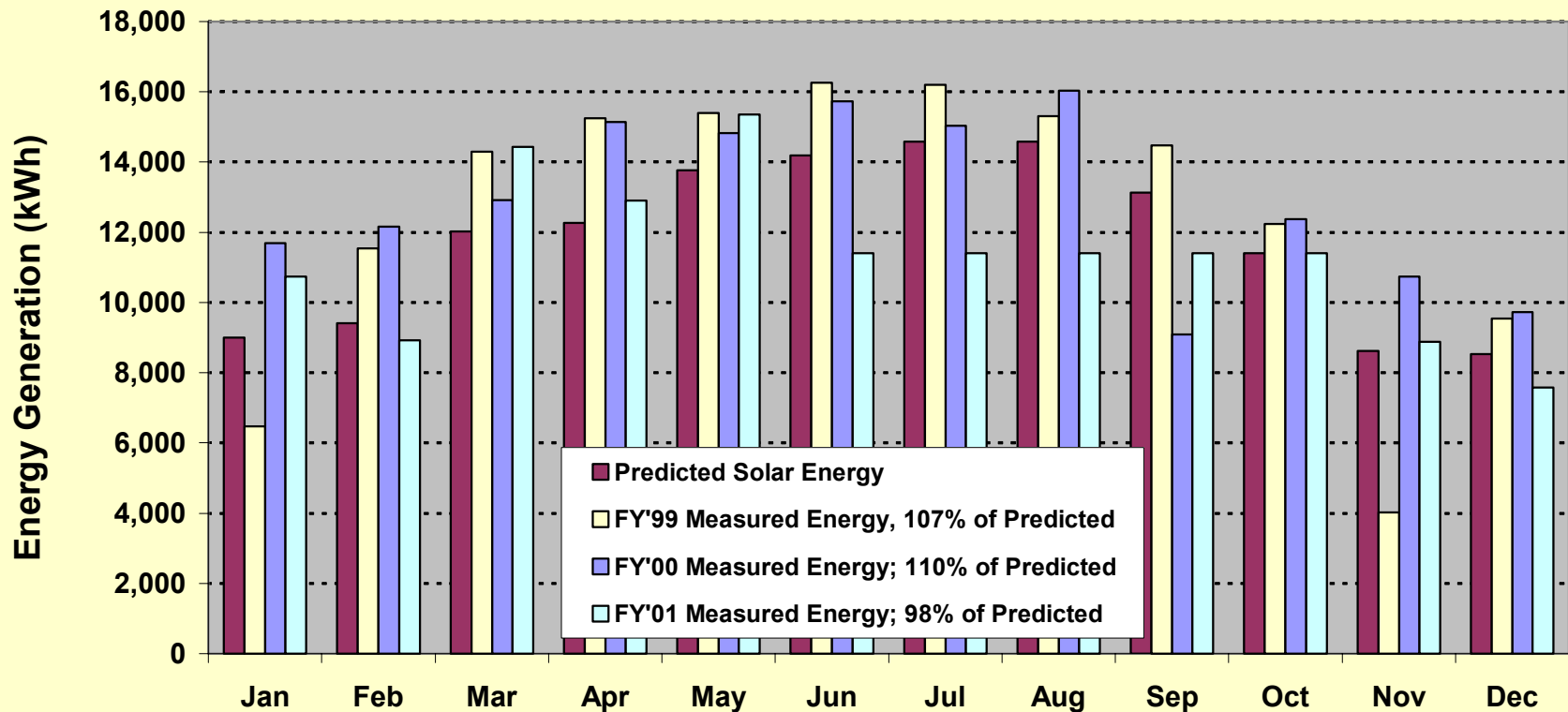


PowerLight Mauna Lani 15 Minute Average Data
6/20/1998 5:00:00 AM to 6/20/1998 8:00:00 PM

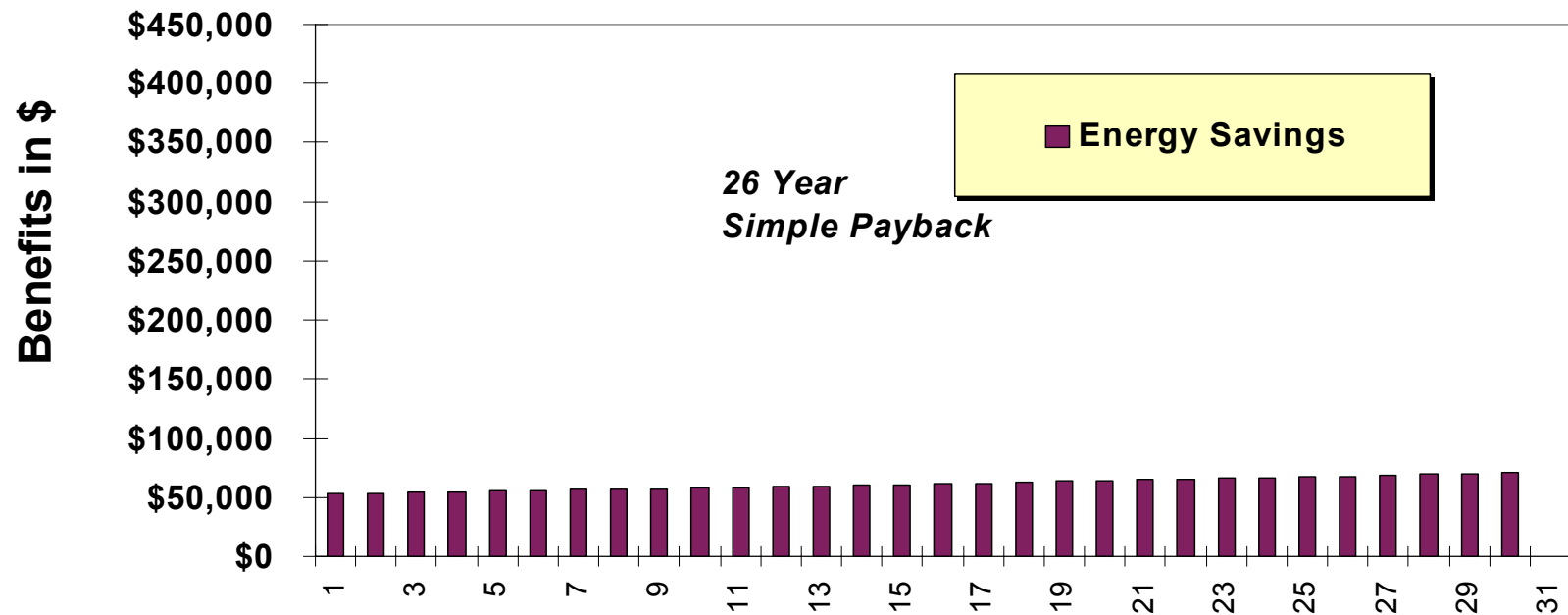


PowerGuard Performance Mauna Lani Hotel; 1999 - 2001

Mauna Lani Bay Hotel: PowerGuard Solar Performance for 1999, 2000, 2001



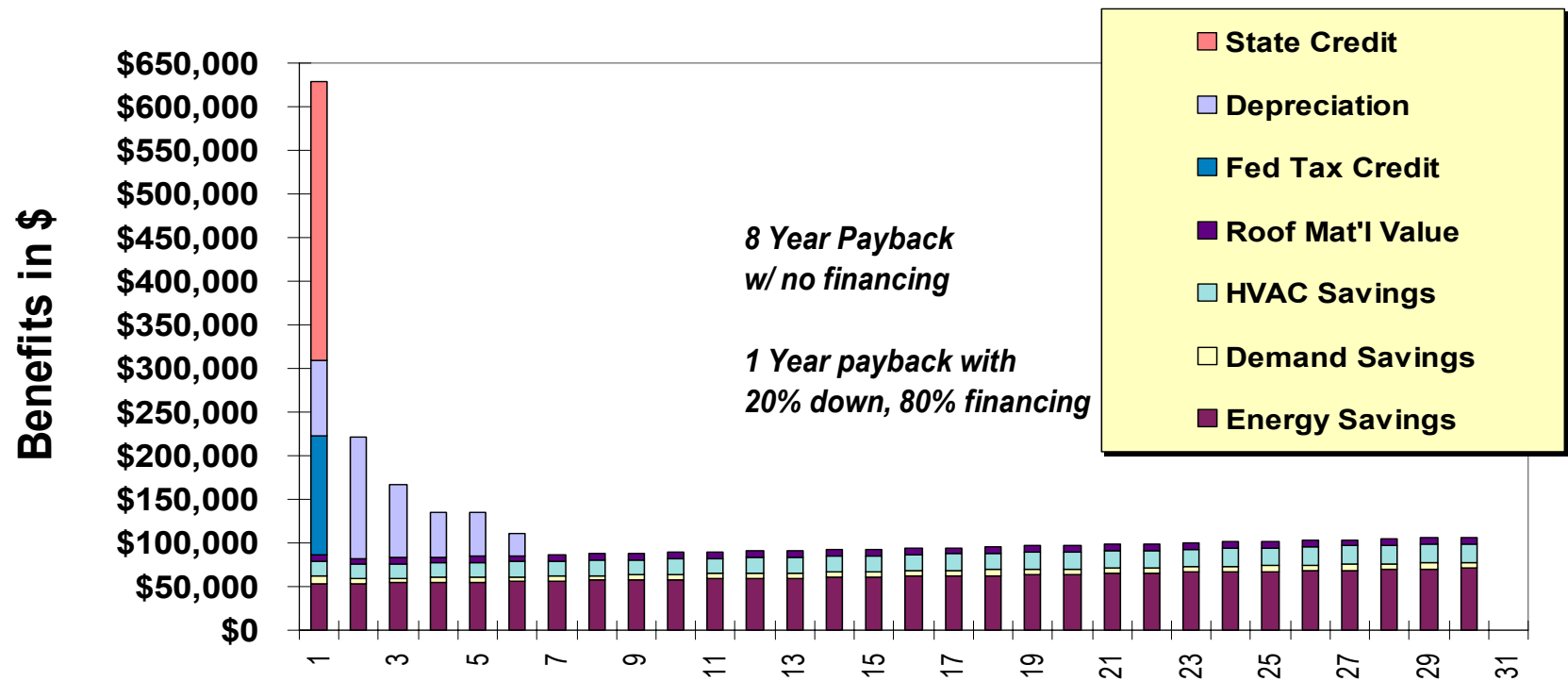
Photovoltaic Building Economics: Simplistic Payback Analysis, Hypothetical \$1.5 million Project



***Case Study 1: Santa Rita Jail
1100 kW PowerGuard System & Energy Efficiency
\$7 Million Net Savings Over Project Life***



Photovoltaic Building Economics: Comprehensive Perspective



Crystalline Progress Example: Sanyo HIP Technology

17.3% Cell / 15.3% module, outdoor testing

